UNITED STATES TARIFF COMMISSION

WASHINGTON

INFORMATION

CONCERNING

MANGANESE ORE

PRINTED FOR USE OF

COMMITTEE ON WAYS AND MEANS

HOUSE OF REPRESENTATIVES

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Office: 1322 New York Avenue, Washington, D. C.

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LETTER OF TRANSMITTAL.

UNITED STATES TARIFF COMMISSION,
Washington, June 14, 1919.

The COMMITTEE ON WAYS AND MEANS OF THE
HOUSE OF REPRESENTATIVES:

I have the honor to transmit herewith, in accordance with your request, information compiled by the United States Tariff Commission on the manganese ore industry.

Very respectfully,

THOMAS WALKER PAGE,
Acting Chairman.

CONTENTS.

MANGANESE ORE.

I. SUMMARY.

Manganese ore is the raw material for ferromanganese or spiegeleisen, products essential to the manufacture of steel. Minor amounts of the ore are required by chemical and other industries, but 96 per cent of the consumption is for making steel.

Prior to the European war the United States produced less than 1 per cent of its manganese requirements. The remainder was imported mainly from India, Russia, and Brazil in the form of ore and from Great Britain in the form of ferromanganese. Under war conditions the first two countries were practically eliminated as sources of supply. Domestic production of high grade (i. e., 35 per cent or more manganese) ore, used largely for making ferromanganese, increased from 4,063 tons in 1913 to about 294,000 tons in 1918. Production of low-grade (less than 35 per cent manganese) ore, used partly for making spiegel and partly smelted direct in iron furnaces, increased from 85,588 tons in 1913 to over 1,079,000 tons in 1918. The number of mines increased from 75 in 1917 to 325 in 1918.

The industry was also considerably expanded in Brazil and in Cuba. The large supplies from these nearer countries together with the increased domestic output proved greater than even the enormously expanded needs of this country. The United States became independent of British ferromanganese and of Indian and Russian ore.

Manganese mining on a large scale in the United States, however, is an artificial industry. Under normal trade conditions, with a free movement of ore from foreign countries, it can not continue except on a very limited output. The domestic resources have been carefully estimated and found to be insufficient to supply domestic requirements for more than a very few years. The cost of mining is relatively high, but that is not the only determining factor. The domestic ore is relatively low grade, obtainable in only small lots [1] and variable in character. Any large dependence on domestic supplies involves the rapid depletion of our limited reserves and a loss in efficiency due to the use of lower-grade material by the consumers aside from the increased cost of domestic ore as compared with the cheaper and more desirable foreign product. The foreign resources are practically inexhaustible and are high grade. They are easily accessible and must eventually furnish the American supply, regardless of any temporary expedients that may lead to the continuance of domestic mining.

During the war period a number of mines were opened up and equipped for the purpose of providing manganese as a necessity in the war program. Many of these properties failed to return the capital invested up to the time of signing the armistice. Since there

[1] Outside of the Butte, Mont., field.

was some justice in the claim that this investment had been undertaken for patriotic reasons, compensation was asked from the Government. Such compensation is in a fair way of being adjusted by subsidies, the manganese industry being one of the four in which such financial losses are to be investigated and liquidated by the Secretary of the Interior under the powers of the War Minerals Relief Act of March 2, 1919.

Summary table.

Calendar year.	Domestic production.[1]	Imports for consumption.	Domestic exports.	Ratio of imports to production.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
	Long tons.	*Long tons.*		*Per cent.*				
1910	2,258	242,348	(2)	10,750	$1,711,131	(3)	$7.06	(3)
1911	2,457	176,828	(2)	7,200	1,186,791	(3)	6.71	(3)
1912	1,664	320,636	(2)	19,270	1,786,098	(3)	5.51	(3)
1913	4,063	345,108	(2)	8,530	2,029,680	(3)	5.88	(3)
1914	2,233	283,464	(2)	10,760	2,024,121	(3)	7.14	(3)
1915	9,654	320,778	(2)	3,300	2,655,980	(3)	8.28	(3)
1916	31,474	569,569	(2)	1,810	8,640,065	(3)	15.17	(3)
1917	128,053	629,972	(2)	490	10,262,929	(3)	16.28	(3)
1918	294,497	491,157	(2)	167	15,056,920	(3)	30.74	(3)

[1] Does not include low-grade ores used for making spiegeleisen. [2] None. [3] Free.

II. GENERAL INFORMATION.

DESCRIPTION.

Manganese is not found in the metallic state in nature; it occurs only in combination with other elements, as oxide, carbonate or silicate, the oxides being the most common.

Principal manganese minerals.

Mineral.	Composition.	Percentage manganese.
Polianite	MnO_2	63.2
Pyrolusite	$MnO_2.H_2O$	60–63
Psilomelane	$MnO_2(MnKBa)O.H_2O$	45–60
Wad, Bog manganese, etc	Impure mixture of hydrous oxides	5–50
Manganite	$Mn_2O_3.H_2O$	62.4
Braunite	$3Mn_2O_3.MnSiO_3$	69
Franklinite	$(FeZnMn)(FeMn)_2O_4$	10–19
Rhodocrosite	$MnCO_3$ (carbonate)	47.56
Rhodonite	$MnSiO_3$ (silicate)	41.9
Tephroite (manganese olivine)	Mn_2SiO_4 (silicate)	54.3
Spessartite (manganese garnet)	$3MnO.Al_2O_3.3SiO_2$	33.3

The domestic supply of manganese comes from four classes of materials: (1) Manganese ores, (2) manganiferous iron ores, (3) manganiferous silver ores, and (4) manganiferous zinc residuum.

The limiting percentage of manganese distinguishing a manganiferous iron ore from a manganese ore is not fixed but varies according to the use to which the ore is put. For steel manufacture manganese ore may contain 5 per cent of iron or even more and still be termed a manganese ore, but for chemical purposes the manganese ore should as a rule contain less than 1 per cent of iron.

Manganese ores are those which contain at least 35 per cent manganese and otherwise conform to the specifications of the trade in which they are used.

Manganiferous iron ores consist of mixtures of manganese and iron oxides and hydrous oxides which, though usually containing manganese in excess of 5 per cent, may contain as little as 1 per cent. The proportion of iron in such ores is highly variable but usually exceeds 40 per cent.

Manganiferous silver ores consist of mixtures of manganese and iron oxides and hydrous oxides, with small quantities of silver and lead minerals. As a rule the iron content exceeds the manganese content, but locally the iron is altogether absent. These ores are more important as fluxes in lead and copper smelting than as sources of recoverable manganese.

Manganiferous zinc residuum is an artificial furnace product consisting of manganese and iron oxides in a matrix of slag. It is obtained from zinc volatilizing and oxidizing furnaces using New Jersey zinc ores. The residuum consists largely of iron and manganese oxides, the zinc having been removed by volatilization and collected as zinc oxide.

USES.

The chief use of manganese ores is for making ferromanganese and spiegel alloys required in steel making. Fully 96 per cent of the manganese ore consumed in the United States goes into the manufacture of steel.[1] Practically all steel contains manganese, and of all the essential alloys ferromanganese is used in the largest quantity. Under present metallurgical methods it is impossible to produce open-hearth and Bessemer steel without adding on the average one-half of 1 per cent manganese, and special steels are made containing up to 10 or 12 per cent. Manganese alloys when added to steel serve as deoxidizers and recarburizers, and impart certain essential qualities—toughness and hardness.

Manganese is also a useful alloy in bronze. Its compounds, generally the oxide, are used in glass making and in electric dry batteries. It is employed in chemical works in the manufacture of chlorine and bromine; is used as a drier for varnishes, and as a coloring material in pottery and brick making, and for green and violet paints. The consumption of manganese ore for these purposes, however, is relatively small compared to its use in steel.

DOMESTIC PRODUCTION.

For over a decade previous to 1915 the domestic production of manganese ore rarely exceeded 4,000 tons annually. Upon the outbreak of hostilities in Europe (August, 1914), the demand for manganese became increasingly evident, and as the need of manganese alloy by steel manufacturers became more urgent prices of the ore rose rapidly. This condition resulted in strenuous efforts to increase production. In 1915 the production increased to nearly 10,000 tons; in 1916, to 31,000 tons; in 1917, to 128,000 tons; and in 1918, to approximately 294,000 tons.

[1] Dr. C. K. Leith for the various U. S. War boards (1918).

HISTORICAL.

Prior to 1870 the value of manganese ore in the iron industry was not generally recognized. The iron used was largely in the form of cast and wrought iron, to which no manganese is added, or of crucible steel in which only a small quantity is required. The development of the Bessemer and open-hearth processes of making steel about this time created a demand for manganese alloys, and during recent years it has been the ordinary practice to add from 10 to 17 pounds of manganese, in the form of ferromanganese or spiegeleisen, to every ton of steel produced by these processes.

For a decade before the European war (1914–1918) the United States produced less than 1 per cent of its supply of manganese, the rest being imported from British India, Russia, and Brazil in the form of ore, and from England in the form of ferromanganese. The closing of the European supply and the partial closing of the British Indian supply, under war conditions, made it necessary to turn to Brazil for our foreign manganese. At the same time vigorous steps were taken to develop domestic resources. Patriotic citizens were urged to embark on new mining ventures with the encouragement and advice of the Government through the War Industries Board, Shipping Board, Geological Survey, and Bureau of Mines. The response measured in actual tonnage of manganese and other munition minerals was amazing, yearly production of manganese increasing almost a hundredfold. The tonnage of high-grade (35 per cent) ore increased from 4,000 tons in 1913 to over 294,000 tons in 1918. Low-grade ores containing from 10 to 35 per cent manganese were used to a larger extent for making spiegeleisen and for direct addition in the smelting of pig iron, without going through the form of ferro alloy. The number of shippers of high-grade ore increased from 18 in 1914 to 210 in 1918.

Even before the passage of the war minerals bill (October, 1918) it was clear that the real necessity for legislative stimulation of production for most of the munitions minerals had passed. The preliminary estimates of consumption as prepared by the different Government departments had been proven excessive. On the other hand, the supply from various sources far exceeded the preliminary production estimates by prospective shippers to the Government in the early part of the year. The natural result of a combination of these factors—overestimate of consumption, change in rate of consumption, underestimate of production, with imports continuing to enter the country in spite of embargo—was a serious congestion of stocks. At the beginning of 1919 consumers are stocked with considerably over a year's requirements in manganese.

As a result of the domestic developments in the manganese situation the Government found it possible in 1917 and 1918 to restrict the importation of ore from Brazil and other foreign countries having a long haul, for the sake of conserving shipping, while importations from Cuba and Central America were encouraged on account of the short haul. Importations of ferromanganese were also restricted early in 1918, but later in the year a special exception was made and 12,000 tons were allowed to enter from England.[1]

[1] Import restrictions effective during the war period are given below under "Imports."

METHODS, PROCESSES, AND EQUIPMENT.

The ordinary methods used in the mining of iron ores are employed in mining manganese ore.

Most of the mining of manganese ore is done near the surface, and the industry is not characterized by heavy investments, although a few producers have installed expensive equipment for surface mining on a large scale and for concentrating the ore.

LOCALITIES OF PRODUCTION.

Manganese ore deposits occur in many parts of the United States, but are most abundant in Montana, the Appalachian and Piedmont regions, in the southern Mississippi Valley, and on the Pacific coast. Small deposits occur in New England and in the Great Basin region.

Up to 1918 the principal producing districts had been the James River, Staunton River, and the Blue Ridge regions in Virginia, the Cave Springs and the Cartersville districts in Georgia, the Batesville district in Arkansas, and the Livermore-Tesla districts in California.

The greater use, small and rapidly decreasing stocks, advancing prices, and other conditions in the manganese situation brought about by the war led to intensive prospecting and abnormal production in 1918. During that year 15 States that had no manganese mines in operation before the war produced over 250,000 tons of high-grade ore. Montana led in production, mining in 1918 over 60 per cent of the country's total. Other important producing States during 1918, following in order of quantity mined, were: California, Nevada, Arizona, and Virginia.

Manganiferous iron ores (5 to 35 per cent Mn), which prior to the war (1914) had been produced chiefly in Minnesota and Colorado, were in 1918 produced in 12 or more States, the principal ones being in order of quantity produced: Minnesota, Wisconsin, Colorado, Nevada, and New Mexico.

Production of manganese ore in United States, by States.[1]

State.	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Virginia	[2] 2,258	[2] $22,892	[3] 2,457	[3] $24,586	[4] 1,664	[4] $15,723

[1] Mineral Resources, U. S. Geological Survey.
[2] Includes Arkansas.
[3] Includes California.
[4] Includes California and South Carolina.

Production of manganese ore (35 per cent and over), in the United States, by States.[1]

[In long tons.]

States.	1913	1914	1915	1916	1917	1918
Alabama			200	27	264	850
Arizona			380	3,060	14,777	17,300
Arkansas			1,288	6,318	10,140	9,500
California		501	2,563	6,136	14,346	25,000
Colorado	15	8	150	110	60	1,667
Georgia			3,168	1,572	3,614	6,900
Montana				6,418	58,989	182,200
Nevada				309	3,450	23,000
New Mexico				506	2,623	2,320
North Carolina					102	315
South Carolina					405	100
Tennessee			150	429	1,879	4,100
Texas			50	800	25	350
Utah			85	1,282	4,880	6,200
Virginia	4,048	1,724	1,620	4,417	12,469	14,300
Wyoming					30	
All other				90		395
Total	4,063	2,233	9,654	31,474	128,053	294,497

[1] Mineral Resources, U. S. Geological Survey.

Production of manganiferous iron ore in United States, by States.[1]

[In long tons.]

States.	1907	1908	1909	1910	1911	1912
Arkansas	4,133	4,066	3,325	5,030	2,177	1,332
Colorado	99,711	51,554	65,024	55,770	41,753	48,618
Lake Superior region	314,316	467,140	775,035	558,634	477,920	816,984
Virginia		274	305	301	507	1,567
All other	7,000					
Total	425,160	523,034	843,689	619,735	522,357	868,501

[1] Mineral Resources, U. S. Geological Survey.

Production of manganiferous iron ore in United States, by States.

[In long tons.]

States.	1913	1914	1915	1916	1917	[1] 1918
Arizona				7,392	34,449	[2] 13,850
Arkansas	9,650	1,970	2,655	3,682	15,315	11,000
California				139	142	60
Colorado	49,738	39,873	15,956	96,875	103,301	[3] 115,000
Georgia			676	4,397	13,281	13,400
Minnesota	26,200	55,192	42,973	240,403	451,163	862,500
Montana					4,505	
Nevada				122,429	122,872	[3] 72,000
New Mexico				16,068	15,900	31,500
Tennessee					90	3,100
Utah				177	136	
Virginia		1,222	1,944	37,700	33,596	17,200
Wisconsin			10,616	3,982	200,327	[4] 210,000
All other				844	53,183	139,300
Total	85,588	98,257	74,820	534,088	1,048,260	[5] 1,079,060

[1] Estimate based on 9 months' returns.
[2] Includes 12,850 tons of fluxing ore not included in total.
[3] Fluxing ore not included in total.
[4] Ore containing 5 per cent (approximately) manganese not included in total.
[5] Does not include ore used for fluxing or ore containing approximately 5 per cent manganese.

RELATION OF DOMESTIC PRODUCTION TO DOMESTIC CONSUMPTION.

The approximate available supply of manganese ore in the United States during the normal years (up to 1914) preceding the European War may be taken as a fair indication of the domestic consumption. During the four years before the war, 1911 to 1914 inclusive, the amount consumed annually ranged from 180,000 to 350,000 tons, the average for the four-year period being 284,000 tons. During the same period the imports of ferromanganese averaged 98,000 tons. The domestic production of ore was comparatively insignificant, amounting to between 1,700 and 4,000 tons annually, the average for the four-year period being 2,700 tons, or only about 1 per cent of the average annual consumption of ore.

Under the influence of high prices and a keen demand, as a result of the greatly increased output of steel for the warring nations in Europe, domestic production of manganese ore began to increase rapidly, amounting in 1915 to 3 per cent of the total consumption; to 5¼ per cent in 1916; to 17½ per cent in 1917; and to 34½ per cent in 1918. The imports of ferromanganese declined during this same period, from 55,263 tons in 1915 to 34,217 tons in 1918.

Consumption.

Calendar year.	Domestic production.[1]	Imports for consumption.[2]		Exports.	Approximate available supply.[4]	Proportion of available supply produced in United States.
		Ore.	Ferromanganese.			
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Per cent.*
1911	2,457	176,828	80,263	.....	363,890	0.68
1912	1,664	320,636	99,137	.....	550,315	.30
1913	4,063	345,108	128,070	.....	643,732	.63
1914	2,233	283,464	82,997	.....	476,590	.47
1915	9,654	320,778	55,263	.....	457,537	2.11
1916	31,474	569,569	90,928	.....	810,177	3.89
1917	128,053	629,972	45,381	5,520	856,881	14.94
1918	[5] 294,497	557,711	34,217	8,227	922,680	31.92

[1] From pp. 11 and 12. Does not include low-grade ores for making spiegeleisen.
[2] From United States Department of Commerce Quarterly Reports of Imports for Consumption.
[3] No domestic ore is exported. Figures are for ferromanganese converted to ore equivalent at the rate of 2.3 tons of ore equal 1 ton of 80 per cent ferromanganese (after consultation with the United States Geological Survey).
[4] Total production and imports less exports. Actual ore plus ore equivalent of ferromanganese, converted at the rate of 2.3 tons of ore equal 1 ton of 80 per cent ferromanganese.
[5] Estimated.

EXPORTS OF DOMESTIC PRODUCT.

The United States is an importer and not an exporter of manganese ore. No domestic manganese is exported, and only insignificant quantities of the foreign ore imported is reexported, nearly all of which goes to Canada. In 1918 small amounts of ferromanganese were exported to Canada and Italy.[1]

FOREIGN PRODUCTION.

Russia and India have for years been the leading manganese ore producing countries, supplying around 80 per cent of the world's requirements. Brazil is also a large producer, normally supplying about 10 per cent of the world's total output.[2] Relatively little ore is used in these countries, most of it being sent to the large consuming countries of Europe and to the United States. The

[1] Dr. C. K. Leith for various United States war boards.
[2] For opinion as to waning importance of Brazil resources, see letter of F. Lynwood Garrison, Auxiliary File.

Indian ore has been used largely by Great Britain, but much of it has gone to the United States, France, and Germany. A small quantity is used in Russia.

Smaller quantities are produced by Germany, Austria-Hungary, Japan, and Spain. That produced by Germany and Austria-Hungary is used in their domestic industries. Japanese and Spanish ore is in large part exported.

In 1915, Cuba became a producer of manganese ore and one of special importance to the United States on account of its close proximity to our eastern seacoast. Cuba produced 9,000 tons in 1915, a quantity about equal to that produced by the United States; and 33,120 tons in 1916, an amount about one-fifth greater than the United States production. The Cuban ore is not as rich in manganese as the ores of this country.

Russia is the main source of high-grade ore for use in chemical industries. The ore is of a fine earthy nature, some of it running from 48 to 52 per cent manganese as it comes from the mine. Concentrate of exceptional purity, obtained by washing, contains 81 to 92 per cent of manganese dioxide and less than 1 per cent of iron. Some of the ore is used in paint and pottery industries, and the high-grade concentrate goes into the manufacture of dry batteries and of flint glass, to which it is admirably adapted.

Although the main advantage of the Russian ore is its purity, by far the larger part of it is used in the iron industry. As a general rule the ore exported has been sorted and will average 51 to 52 per cent manganese, about 0.16 per cent phosphorus, and not over 8 per cent silica.[1] There are some serious practical objections to the physical character of the Caucasian manganese ore.

The Japanese ore rivals the Russian product in purity but is not produced in such large quantities. It is, however, an important source of ore for battery and chemical purposes, especially during the late war period.

Production of manganese ore in principal foreign countries.[2]

[In long tons.]

Countries.	1910	1911	1912	1913	1914	1915	1916	1917	1918
Canada	.....	5	67	.....	25	180	854	141	.....
Cuba	.....	.....	.....	.....	.....	9,000	33,120	48,031	[3] 85,390
Brazil [4]	249,954	171,172	152,431	120,368	180,738	284,111	[3] 495,172	.....	.....
Austria	15,447	15,703	12,275	16,280	(5)	(5)	(5)	.....	.....
Bosnia and Herzegovina	3,937	3,513	4,577	5,709	4,055	(5)	(5)	.....	.....
France	7,874	5,906	5,488	7,610	(5)	(5)	(5)	.....	.....
German Empire	79,291	85,921	(6)	(7) 748	(5)	(5)	(5)	.....	.....
Greece	40	721	7,595	.....	.....	(5)	(5)	.....	.....
Hungary	13,061	14,523	10,662	18,706	(5)	(5)	(5)	.....	.....
Italy	4,134	3,460	2,599	1,596	1,623	[8] 12,379	18,147	.....	.....
Russia	719,90	[9] 572,028	[9] 911,742	[9] 1,289,370	703,762	[9] 8,705	[10] 8,722	.....	.....
Spain	8,47	5,519	17,126	21,254	12,947	14,102	13,954	.....	.....
Sweden	5,71	5 347	5,082	3,938	3,585	7,487	35,854	.....	.....
United Kingdom	5,46	4,987	4,170	5,393	3,437	4,640	5,140	.....	.....
India	800,90	670,290	633,080	815,047	682,898	450,436	(5)	.....	.....
Japan	11,12	9,615	11,862	18,016	16,807	5,400	7,749	.....	.....
Cape Colony	5	[4] 116	.....	(5)	(5)	(5)	(5)	.....	.....
Australia	81	1,151	328	27	6	200	(5)	.....	.....

[1] E. C. Harder, U. S. Geological Survey.
[2] Mineral Resources, U. S. Geological Survey.
[3] Preliminary estimate.
[4] Exports.
[5] Statistics not yet available.
[6] Statistics not available for Empire. Prussia produced 91,018 tons.
[7] Ore with 30 per cent manganese, 748 tons; ore with 12 to 30 per cent manganese, 324,823 tons.
[8] Ore with 18 to 45 per cent manganese.
[9] Exports from Pati and Batum. Shipments from Tschiatouri district, Kutais Province, were 703,269 tons in 1914, 31,470 tons in 1915.
[10] Shipments from Tschiatouri district, Kutais Province, in 1916 were 117,800 tons.

TRANSPORTATION.

The greater part of the imported ore goes to consumers over comparatively short distances by rail from the entry ports of Baltimore and Philadelphia. One large consumer—of Cuban ore chiefly—located at Sparrows Point, Md., unloads the ore directly from vessel to plant.

Most of the Russian ore has come from the district of Tschiatouri over from 90 to 126 miles of railroad to the ports of Pati and Batum on the Black Sea. Much of the Russian ore imported into the United States before the war (1914–1918) was transshipped from England and Germany.

Most of the ore mines of British India are located on railways, although some of the ore is carted from the mine to the railroad over distances varying from 1 to 20 miles and then transported by rail from about 130 to 600 miles to the shipping ports Bombay, Calcutta, Madras, or Goa.

The bulk of the ore exported from Brazil is mined from 283 to 310 miles from the shipping port of Rio de Janeiro, to which it is transported from the mines by rail.

The ore of Cuba comes chiefly from the Province of Oriente, much of which must be transported in carts or automobiles from 3 to 15 miles to the railroad. The ore has only a short distance to travel by rail to the ports of Santiago and Nipe, from which it is shipped to the United States.

IMPORTS.

Before the outbreak of hostilities in Europe (1914) the United States received nearly all of its foreign manganese ore from three countries—British India, Brazil, and Russia. In the fiscal year 1914 the last normal year before the war, these three countries supplied 99 per cent of the total imports, divided as follows: British India 40 per cent, Brazil 25 per cent, and Russia 34 per cent. After 1915, because of war conditions, imports from Russia stopped and the quantity received from British India was greatly reduced; consequently imports from Brazil began to show large annual increases.

In 1915 Cuba began mining manganese ore, the industry being promoted by American interests and the entire production sent to the United States. The quantity imported from Cuba shows annual increases from 550 tons in the fiscal year 1915 to 67,780 tons in 1918 an amount equal to one-twelfth of our total imports.

Imports by countries.

MANGANESE, OXIDE AND ORE OF.

Imported from—	1910		1911		1912	
	Long tons.	Dollars.	Long tons.	Dollars.	Long tons.	Dollars.
Europe:						
Belgium	795	9,937	1,494	16,965	673	8,539
France	4,528	58,899	3,398	44,648	4,233	53,234
Germany	4,376	80,765	4,919	83,809	2,431	60,867
Netherlands	815	8,000	169	2,927	1,015	11,828
Russia in Europe	50	805	710	10,392	5,450	30,635
United Kingdom	2,359	42,138	935	18,629	750	14,616
North America:						
Canada	353	4,758	31	695	56	2,071
Cuba	2	26	.....	.....	.....	.....
South America:						
Brazil	45,650	446,309	57,700	534,263	63,680	421,680
Asia:						
British India	138,825	662,117	130,755	643,907	98,091	459,549
Japan	1,380	20,679	7	97	.....	.....
Russia in Asia	37,904	257,640	9,091	96,695	21,580	229,406
All other	.....	.....	2	150	.....	.....
Total	237,037	1,592,073	209,211	1,453,177	197,959	1,292,425

Imported from—	1913		1914		1915	
	Long tons.	Dollars.	Long tons.	Dollars.	Long tons.	Dollars.
Europe:						
Belgium	.....	.....	250	3,313	200	2,600
France	416	5,755	703	8,403	.....	.....
Germany	2,979	82,468	1,617	109,926	1,238	61,021
Netherlands	.....	.....	.....	.....	2,555	54,005
Russia in Europe	13,636	83,848	34,810	197,736	2,500	12,285
United Kingdom	202	8,044	219	12,951	8,292	135,763
North America:						
Canada	5	631	.....	.....	154	3,157
Cuba	.....	.....	.....	.....	550	9,904
South America:						
Brazil	71,300	443,523	72,189	466,125	121,155	781,224
Asia:						
British India	167,319	845,871	115,685	571,413	58,975	286,951
Japan	3	78	.....	.....	722	16,478
Russia in Asia	125,736	693,812	63,230	471,544	10,510	130,420
All other	5,600	32,631	3	40	8	1,177
Total	387,196	2,196,661	288,706	1,841,451	206,859	1,494,985

Imported from—	1916		1917		1918	
	Long tons.	Dollars.	Long tons.	Dollars.	Long tons.	Dollars.
Europe:						
Germany	3	2,017	.....	.....	.....	.....
United Kingdom	108	8,167	500	88,317	2,239	383,732
North America:						
Canada	710	56,585	440	40,060	832	32,928
Costa Rica	357	11,363	4,095	116,824	6,017	181,575
Panama	3,115	89,019	9,885	248,873	3,676	129,000
Mexico	11	836	379	6,282	1,114	32,605
Cuba	20,335	338,528	33,534	461,835	67,780	1,479,314
South America:						
Brazil	409,605	4,330,137	541,043	8,965,110	427,267	9,090,380
Chile	.....	.....	.....	18	2,804	44,838
Asia:						
British India	52,999	312,466	60,136	498,634	37,150	442,557
Japan	4,909	180,772	3,007	92,608	2,419	79,615
All other	708	28,203	3,069	27,425	6,720	44,941
Total	492,860	5,358,093	656,088	10,545,986	558,018	11,944,515

Grades and kinds.—Nearly all of the ore used in the manufacture of dry batteries and in the chemical industry has come from Russia. Most of the ore imported from Russia, however, goes into steel making, although some objection has been found to it on account of its fineness. A much smaller supply of chemical ore of similarly high purity is also imported from Japan.

Twenty analyses of manganese ores from 10 districts of British India showed the following ranges in percentage composition: Manganese, 30 to 58.64; silica, 1 to 18.48; and phosphorus, 0.01 to 0.65. The average analysis, in percentages, was: Manganese, 49.13; silica, 5.43; and phosphorus 0.18.[1]

Brazilian ores from the Lafayette and Bahia districts showed in 10 analyses: Manganese, 43 to 55.14 per cent; silica, 1 to 7 per cent; and phosphorus, 0.01 to 0.15 per cent. The average analysis was: Manganese, 50.82 per cent; silica, 2.68 per cent; and phosphorus, 0.057 per cent.[1]

A census of manganese ore in the United States taken by the United States Geological Survey showed the following analysis of foreign stocks on hand July 31, 1918:

Average manganese content of stocks of foreign manganese ore in the United States on July 31, 1918.

Country.	Manganese content.	Country.	Manganese content.
	Per cent.		*Per cent.*
Russia	44.03	Chile	48.00
British India	50.65	Panama	51.04
Brazil	43.00	Porto Rico	50.79
Cuba	37.50	Mexico	43.20
Costa Rica	44.60	Japan	55.30

Import restrictions.[2]—The American Iron and Steel Institute acted as consignee for all manganese (including ore and ferro-manganese) from December 15, 1917, until February 20, 1919. Transoceanic shipments were greatly restricted and after July 19, 1918, even Asiatic ore was practically cut off until January, 1919, when the importation of manganese ore was permitted from any nonenemy country.

Distribution in United States for consumption.—Most of the foreign manganese ore enters the United States through the ports of Baltimore and Philadelphia, from where it is distributed largely to the various ferromanganese furnaces of Maryland and Pennsylvania.

Persistence.—Up to the present time (1918) imports of manganese ore have been made in quantities varying but little from year to year. The insufficient home production of high-grade ore and the more uniform quality of the foreign ore are the factors responsible for the steady importation.

[1] E. C. Harder, U. S. Geol. Survey. (The Brazilian ores are now, 1919, not so high grade. F. L. Garrison.)

[2] This subject is treated more fully in T. I. C. Unit No. 5, p. 4d, and in the Auxiliary File.

Imports for consumption, by fiscal years.

MANGANESE, OXIDE AND ORE OF.

Fiscal years.	Rates of duty.	Quantities (long tons).	Values.	Value per unit of quantity.
1907	Free	205,295.86	$1,672,654	$8.15
1908	do	218,568.42	1,773,018	8.11
1909	do	165,059.75	1,243,657	7.53
1910	do	247,226.63	1,594,425	6.45
1911	do	209,566.80	1,453,177	6.93
1912	do	197,959.81	1,292,435	6.53
1913	do	407,168.99	2,195,565	5.39
1914	do	288,837.00	1,841,472	6.37
1915	do	206,913.00	1,494,965	7.23
1916	do	492,967.00	5,358,087	10.87
1917	do	656,026.00	10,542,572	16.07
1918	do	557,711.00	11,944,515	21.42

Revenue.—Manganese oxide and ore have been admitted free of duty since 1872.

PRICES.

The value of manganese ores depends on their mineralogical nature as well as on their purity and manganese content. The prices paid for ores of medium grade, for which the demand is greatest, are relatively stable, but the value of high-grade ores, which are consumed in much smaller quantities and for special purposes, fluctuates greatly.

The price of manganese ore reached $1 and higher per unit in 1917, as compared with a price of 65 cents in 1916, 45 cents in 1915, and from 23 to 30 cents before the war. Based on 50 per cent ore, the standard grade suitable for the manufacture of ferromanganese, these prices correspond to $50, $32.50, $22.50, and from $11.50 to $15 per long ton.

Heavy discounts obtained for ore containing lower percentages of the metal. As late as 1915, ore containing less than 40 per cent had a very limited market. But the differentials narrowed during the war period by reason of the shortage of imported ore and the generally low grade of domestic deposits. The annual average prices given below are the averages for domestic ore of varying grades, f. o. b. mines and reflect the low grade of the material.

Average wholesale prices of manganese ore.[1]

[Per long ton of domestic ore at mine.]

Years.		Years.	
1910	$10.14	1914	$10.39
1911	10.01	1915	11.67
1912	9.45	1916	23.24
1913	10.00	1917	28.00

Government price fixing was the factor in the latter part of 1918. Previous to that, the schedule of the Carnegie Steel Co., of Pittsburgh, Pa., was the standard of value. Both these schedules are given in detail in the Auxiliary File. The specifications are based on ore containing not over 8 per cent silica and not more than 0.25 per

[1] Mineral Resources, U. S. Geological Survey.

cent phosphorus. Excess of these impurities above these limits is penalized. In general, very little ore containing an excess of 25 per cent silica can be used.

The fluctuations in the prices of foreign ore are reflected fairly accurately in the statistics of imports. The prices show a gradual fall down to a minimum of only a little more than $5 a ton in 1913, with a rapid rise during the war period. Statistics as to the prices of manganese ore in foreign countries have not been obtained, but they are known to be much lower than in the United States. Manganese ore was shipped to England from British India in ballast and was sold to consumers there much cheaper than American consumers could get their supplies.

TARIFF HISTORY.

Manganese ore has been exempt from duty since 1872. Foreign countries generally also admit it free of duties.

Rates of duty.

MANGANESE, OXIDE AND ORE OF.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883.....	623	Manganese, oxide and ore of.....	Free.
1890.....	643	.....do.....	Do.
1894.....	546	.....do.....	Do.
1897.....	607	.....do.....	Do.
1909.....	619	.....do.....	Do.
1913.....	540	.....do.....	Do.

COURT AND TREASURY DECISIONS.

There have been many decisions upon what constitutes manganese ore for tariff purposes. In 1879 the Treasury Department held that to be dutiable as manganese ore the commodity must contain 50 per cent or more of manganese and not more than 10 per cent of iron. (Dept. Order, T. D. 4114; followed in T. D. 7273.)

An importation containing less than 50 per cent of manganese but not more than 10 per cent of iron was, however, held entitled to free entry either as manganese ore or as an unenumerated article similar thereto. (Appeal, T. D. 9954.)

Ore containing from 48 to 51 per cent of manganese and from 1 to 2 per cent of iron was held entitled to free entry as manganese ore. (Dept. Order, T. D. 16550.) These percentages were next changed to 40 to 50 per cent of manganese or more and less than 10 per cent of iron. (Dept. Order, T. D. 19184.)

A product recoverable from manganese after use in the manufacture of chlorine was held exempt from duty as oxide of manganese. (Appeal, T. D. 8429.)

Oxide of manganese, classified as a chemical compound, was held entitled to free entry under the specific provision therefor in the act of 1909. (Abstract 35681, T. D. 34468.)

Merchandise, invoiced as Braunstein Grob, consisting of a chemical mixture composed of manganese oxide and about four-tenths of 1 per cent of nickel oxide, was held exempt from duty as oxide of manganese

and not dutiable as a chemical mixture under the act of 1909, nickel oxide being declared naturally present. (Abstract 36912, T. D. 34933.)

COMPETITIVE CONDITIONS.

During the war period, the production of manganese ore in the United States was a profitable industry in many localities, but only because prices were from three to four times those existing prior to the outbreak of hostilities in Europe. With the return of prewar conditions the industry faces practical annihilation.

Foreign ores are of better average grade and more easily mined than the domestic deposits. The average grade of imported ore is from 45 to 55 per cent manganese as compared to domestic "high grade" running from 35 to 45 per cent. Operating costs in the United States are much higher. Another factor is that most of the American mines are situated in localities remote from the points of consumption, often at considerable distances from the railroad.

Until the dislocation of shipping as a result of the submarine menace, it was generally believed that domestic mines could not furnish any large tonnage of manganese. The record of production disproves this impression, but the domestic industry was developed only under extraordinary conditions, high prices, and practically complete freedom from foreign competition. The war disturbance also fostered a mushroom industry in Cuba and other countries that had not hitherto been able to develop any important output as long as shipments from India, Russia, and, to less extent, Brazil were unrestricted. Costs in all districts increased greatly, but nowhere did they increase as much as they did in the United States.

RESERVES.

Domestic reserves of manganese ore are sufficient for only a few years. The amount of high-grade ore (35 per cent or more) in sight is only 699,750 tons, with 1,130,000 tons more in prospect.[1] Taking the normal consumption in this country as 350,000 tons, these reserves would be exhausted in from two to five years.[2]

Russia, India, and Brazil have very large deposits of manganese ore. The reserves of the Tschiatouri and Nicopal districts in Russia are estimated at 117,400,000 tons. Three districts in India have reserves of 11,137,000 tons, while the reserves of two mines (Wigg and Morro da Mina) of Minas Geraes, Brazil, are 7,000,000 tons.[3] This ore is all much higher grade than that of the domestic deposits Other countries have less important supplies.

COSTS.[4]

The average cost of producing clean manganese ore (containing 35 per cent or more manganese) in the United States in the latter part of 1918 was $19.53 per long ton f. o. b. mine. To this must be added the freight to the furnace and war taxes.

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[1] U. S. Geological Survey, Dec. 1918.

[2] On basis of an annual production of 45,000,000 tons steel domestic consumption of manganese ores is about 800,000 tons. The reserves in known deposits therefore are only available for one or possibly two or three years.

[3] E. C. Harder. Manganese Ores of Russia, India, Brazil, and Chile. 1916.

[4] A detailed study of domestic, Brazilian, and Cuban costs by W. R. Crane of the U. S. Bureau of Mines will be found in the Auxiliary File and has been drawn upon freely for the figures presented in this section.

Cost per ton of production and delivery in the United States of domestic and foreign manganese ore.

Cost items.	United States.[1]	Russia.[2]	India.[3]	Brazil.[4]			
				Morro da Mina.	Wigg Mine.	Ouro Prato.	Santa Barbara.
Mining f. o. b. cars	$19.53	$1.45	$0.32–$0.97	$4.00	$5.00	$5.00	$5.00
Freight to furnace, war taxes, etc	3.47	3.00	3.00	3.00	3.00	3.00	3.00
Transportation to shipping port	.....	3.12	4.28– 6.85	2.15	2.15	5.60	[7] 8.15
Export tax	.....	.....	.....	1.85	1.85	.....	.....
Port and other charges	.....	1.12	.53– 1.04	.....	.....	2.50	2.50
Ocean freight	.....	[5] 3.77	3.24– 4.26	[6] 15.00	[6] 15.00	[6] 15.00	[6] 15.00
Total	23.00	12.46	11.37–16.12	26.00	27.00	31.10	33.65

[1] W. R. Crane, U. S. Bureau of Mines. Cost of Manganese Production in the United States.
[2] Tschiatouri district. E. C. Harder, U. S. Geol. Survey. Manganese Ores of Russia, India, Brazil, and Chile, 1916.
[3] Central provinces. Memoirs 37. Manganese Deposits of India, Fermor, converted at 1 rupee ($0.3244).
[4] E. C. Harder, Report to Dr. C. K. Leith. Nov. 1, 1918, covering trip in 1917. Ouro Prato and Santa Barbara have suffered increased freight rates, the other companies are still operating under old contracts.
[5] Rate from Pati to Philadelphia and Baltimore. Shipping World. June 11, 1913.
[6] War-time rate. Prewar rate $2.88.
[7] Includes $2.50 haulage to station.

These items ranged from $3.50 to $12 per ton according to the locality. A fair average of the cost of ore delivered at the furnace during that period is $23 per long ton, or, based on the average manganese content of 41 per cent, $0.56 per unit of metal content.[1]

Cost of manganese ore delivered at furnace under war conditions.[2]

	Tonnage for 1918.	Estimated cost f. o. b. railway cars.	Estimated freight to furnace.	Total cost delivered furnace.	Average per cent manganese;	Estimated cost per unit of manganese.
UNITED STATES.						
Alabama	850	$12.00	$7.50	$19.50	50	$0.50
Arizona	17,300	14.00	11.00	25.00	41	.61
Arkansas	9,500	17.50	5.00	22.50	41	.55
California	25,000	12.00	13.00	25.00	43	.58
Georgia	6,900	15.00	7.50	22.50	40	.56
Montana:						
Butte	63,000	5.00	11.00	16.00	37	.43
Philipsburg	119,000	15.00	11.00	26.00	42	.62
Nevada	23,000	12.00	12.00	24.00	42	.57
New Mexico	2,300	14.00	10.00	24.00	42	.57
Tennessee	4,100	22.50	6.00	28.50	20	.71
Utah	6,200	14.00	11.00	25.00	43	.58
Virginia	14,000	15.00	3.50	18.50	42	.44
Others	3,347	.....	.....	.....	.....	.....
Total	294,497	.....	.....	.....	.....	.....
Weighted average	.....	.....	.....	23.00	41	.56
FOREIGN.						
Cuba	.....	.....	.....	29.00 16.00	.....	.74 .40
Brazil	.....	.....	.....	33.35 18.00	.....	.74 .40

[1] This average includes many small mines. At chief points of production in Montana (the main domestic field)—namely, Butte and Philipsburg—a cost considerably less than this would be shown. It is claimed by Anaconda Copper Manufacturing Co. that if industry were on a more permanent basis, cost would reduce to $10 or $12 per ton.
[2] W. R. Crane, U. S. Bureau of Mines. Cost of Manganese Production in the United States.

For the same period, the cost of Brazilian ore was over $30 and that from Cuba somewhat less than $30 per long ton delivered at American furnaces. There are no data available as to costs of production during this period in Russia or India, but it is probable that the costs of production were only slightly greater than those prior to the war, although the prohibitive ocean freight rates would have to be added for comparison with the above figures. The advantage of the domestic producers as compared to those in Brazil and Cuba was due solely to the extraordinary increase in freight, which, in the case of Brazil, had increased from a prewar level of $2.88 to $15 per ton and in Cuba from about $3 to over $9. State and export taxes in the former country and heavily increased royalties in the latter served to further increase the cost of the ore in the American market.

The prewar costs are easier to determine in the case of foreign ores and much more difficult in the case of domestic ores than those of the war period. Under the old freight rate of $4.32 from India to the United States, ore from that country was laid down at American furnaces at a cost rarely to exceed $14 per ton and probably averaging about $10. This latter figure may also be taken as an approximation for Russian ore.[1] Brazilian costs were $9.53 delivered at the Atlantic seaboard of the United States. At that time some ore was mined in our Southern States at a cost of about $5 per ton, but it was mined by farmers in their spare time and, therefore, can not be considered a reasonable approximation of fair mining practice. A better approximation of the cost of producing the almost negligible prewar domestic output is $8.

The estimated[1] future cost of domestic manganese ore is about $5 less than the present cost or about $14.65 per ton at the mine. This compares with a similar estimate of a little more than $15 for Brazilian ore laid down on the Atlantic seaboard. Costs of other foreign ores depend almost wholly upon the adjustment of ocean freight rates. Normal conditions can not be expected much before 1921, but Indian ore should make its appearance again in American markets considerably before that date.

TRANSPORTATION.

Foreign ores have the advantage over domestic ores in that the freight rates from tidewater to the furnaces are lower than those from domestic mining districts to points of consumption. The only exceptions to this rule are certain localities in the Southern States.

OTHER FACTORS.

As indicated in the cost data cited above, the chief disadvantage of domestic ore is not that it costs more to mine and put on the market. If it were purely a matter of cost, this country could doubtless have furnished a somewhat larger fraction of its needs from domestic mines. The main trouble has been the character of the American ore and the sporadic nature of the production.

These controlling factors may be summed up as follows:

[1] W. R. Crane. Auxiliary file. Loc. cit.

DOMESTIC ORE.	IMPORTED ORE.
1. Mostly low grade.[1]	1. Medium to high grade.
2. Very variable in grade.[1]	2. Fairly uniform in grade.
3. Generally contain undesirable impurities (especially silica).	3. Generally free from undesirable impurities (nonsilicious).
4. Production and shipments irregular and usually in small lots.[2]	4. Supply uniform and dependable and in large lots.

FREIGHT RATES.

In August, 1918, Director General of Railroads W. G. McAdoo announced new rates on manganese ore which were lower than those previously prevailing. The rates apply to shipments in carload lots, per net ton, minimum carload weight 60,000 pounds. To Chicago: From Colorado and New Mexico, $7; Montana, $8; Arizona, $9; Nevada, $10; Oregon, Washington, and California, $11. To Atlantic seaboard: From Colorado and New Mexico, $9.50; Montana, $10.50; Arizona and Utah, $11.50; Nevada, $12.50; Washington and California, $13.50; Oregon, $15.50.

EXPORT DUTIES.

Russia imposed an export duty on manganese ore of $\frac{1}{4}$ kopeck per pood ($\frac{1}{8}$ cents per 36.11 pounds) after 1914. This is equal to about $7\frac{3}{4}$ cents per long ton.

In Brazil export duties are imposed not by the Federal but by the several State governments.

The State of Minas Geraes passed a law in 1917 placing an export duty on manganese. The duty is based on a sliding scale of 4 per cent, 6 per cent or 8 per cent, according as the official valuation is less than 40 milreis, from 40 to 50 milreis, or more than 50 milreis per ton. In addition to the ad valorem duty there is a special tax of 1, 2, or 3 francs per ton, dependent upon the official valuation under the same conditions as the ad valorem duty. During the high prices for manganese ore of late years the highest export rates have applied.

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The Mineral Industry, G. A. Roush.

Manganese Ores of Russia, India, Brazil, and Chile, 1916. E. C. Harder, geologist, United States Geological Survey.

Cost of Manganese Production in the United States, War Minerals Investigations. W. R. Crane, United States Bureau of Mines, (in auxiliary file).

TRADE JOURNALS.

Engineering and Mining Journal.
Metallurgical and Chemical Engineering.
Iron Trade Review.
Iron Age.
Mining and Scientific Press.

[1] It should be said that in Montana (which State in 1918 produced over 60 per cent of domestic total) the controlled mining practice of the large companies and the size of the deposits make it possible to mix high-grade Philipsburg ore (42 to 45 per cent Mn, 16 per cent SiO_2) with lower-grade Butte ore (35 to 40 per cent Mn, 7 per cent SiO_2) and maintain a fair, uniform grade of material.

[2] It is stated by Anaconda Copper Mng. Co. (letter May 5, 1919, in auxil. file) that Butte could with reasonable certainty be counted on for 162,500 tons per year, which, added to 119,000 from Philipsburg, would give a total of 281,500 tons, nearly equal to average total consumption manganese ores during the five years, 1910 to 1914. Philipsburg ore reserves questionable; Butte, enormous but unknown.

SHIPPERS OF MANGANESE ORES.

Alabama:
Joseph R. Cook, 421 American Trust Building, Birmingham.
Arizona:
Buckingham & Wright, Globe.
Bunker Hill Mines Co. (Phelps Dodge Corporation), Tombstone.
Burmister & Bunker, Mayer.
Calumet & Arizona Mining Co., Bisbee.
F. A. Chamberlain, Florence.
Copper Queen Consolidated Mining Co. (Phelps Dodge Corporation), Bisbee.
J. Gilbin, Wickenburg.
Thomas Higgins, Bisbee.
Jamison & Bailey, Globe.
Manganese Development Co. (Girand & Craig), Phoenix.
Jack Marden, Head Hotel, Prescott.
Noble Electric Steel Co., 995 Market Street, San Francisco, Calif.
Shattuck-Arizona Copper Co., Bisbee.
Superior & Globe Copper Co., Globe.
Wheeler property, Wickenburg (J. B. Girand, Phoenix).
Woods, Huddart & Gunn, San Francisco, Calif.
Arkansas:
N. A. Adler, Batesville.
W. H. Dennison, Cushman.
Eureka Manganese & Mining Co., Cushman.
R. S. Handford, Cushman.
Independence Mining Co., Cushman.
Marqua Mining Co., Cushman.
Martin Manganese & Mining Co. (Inc.), Roanoke, Va. (E. C. McCombe, Batesville).
Standard Manganese Co., Batesville (prospective shipper).
California:
C. V. Brereton, Covelo.
John Burmeister, Hollister.
S. C. Burris (Vann & Burris), Potter Valley.
S. H. Busch, Potter Valley.
Cary-Hoff Manganese Co., foot Twenty-second Street, Oakland.
James J. Cummings, 2165 East Twenty-seventh Street, Oakland.
Morgan M. Day, Mount Hamilton.
John J. Everharty, 254 North Soto Street, Los Angeles,
Federal Ore Co. (Shanks & Combs).
Holbrook & McGuire, 1002 Crocker Building, San Francisco.
Levensaler-Spier Corporation, Monadnock Building, San Francisco.
Livermore Manganese Co., Livermore.
McRae & Murphy, Aurora, Nev.
Manganese Co. of California, 180 Sutter Street, San Francisco.
Mineral Products Co., 334 Rialto Building, San Francisco.
D. A. Mitchell, Tracy.
E. P. Newhall, Livermore.
Noble Electric Steel Co., 995 Market Street, San Francisco.
H. T. Overaker, Livermore.
William Pickle, Ukiah.
Plant & Robinson, 522 Insurance Exchange Building, San Francisco.
Ruhser & Huberty, Jackson.
Victor R. Smith, Box 733, Fresno.
E. T. Stewart, South Dos Palos.
J. A. Waldteufel, Ukiah.
Western Rock Products Co., M. C. Seagrave, Balboa Building, San Francisco.
George W. Woolley, Clipper Mills.
Alex. Yeoman, 412 Union Oil Building, Los Angeles.
Prospective shippers—
Charles F. Bradford, Blythe.
Clarke & McDonald, Livermore.
Hall & Washbish, Box 153, Parker, Ariz.
Harvey McClindon, Ukiah.
K. G. McLaughlin, San Jose.
Frank Rose, Talent, Oreg.
Harold Wheeler, University Club, San Francisco.

Colorado:
J. D. Batie, 130 Michigan Street, Pueblo.
Prospective shippers—
Boyer & Frankenbery, Salida.
Colorado Manganese Mining and Smelting Co., 627 Symes Building, Denver.
Georgia:
Anson G. Betts & Co., Asheville, N. C.
Cope & Gatterr, Cartersville.
Evans & Ingram, Cartersville.
T. J. Garrett, Cartersville.
H. M. Hebble, Cartersville.
J. M. Knight, Cartersville.
Wesley Knight, Cartersville.
Wilbut A. Nelson, Cartersville.
Republic Iron & Steel Co., W. J. Penhallegon, general superintendent, Birmingham, Ala.
Sidney Simmons, Cave Spring.
Prospective shippers—
Georgia Iron & Coal Co., Joel Hurt, president, Atlanta.
Markstein Dorn Mining Co., D. H. Markstein, secretary, White.
Michigan:
Verona Mining Co., care Pickands, Mather & Co., Cleveland, Ohio.
Minnesota:
Consolidated Vermillion and Extension Co., 301 Sellwood Building, Duluth.
Cuyuna Mille Lacs Iron Co., W. H. Locker, 410 Lonsdale Building, Duluth.
Hill Mines Co., Wilbur Van Evera, Ironton.
Joan Mining Co., Marcus L. Fay, secretary, 106 Providence Building, Duluth.
Mahnomen Mining Co., Clement K. Quinn, president, Alworth Building, Duluth.
Mangan Iron & Steel Co., 321 Manhattan Building, Duluth.
Merritt Development Co., Franklin W. Merritt, president, 514 Plymouth Building, Minneapolis.
Onahman Iron Co., C. A. Lanigan, secretary, Fargusson Building, Duluth.
Sultana Mines Co., Ironton.
Montana:
Auerbach Mining & Mill Machinery & Supply Co., H. Auerbach, president, Philipsburg.
Beaver Creek Mining Co., Philipsburg.
J. C. Cape & Co., Philipsburg.
Clark-Montana Realty Co., box 1368, Butte.
Courtney Bros., Philipsburg.
Maynard Hunt, Philipsburg.
Manganese Mining Co., Philipsburg.
Montana Manganese Co., Philipsburg.
Willard L. Morrison, Apex Hotel, Butte.
Mussigbrod Co., Ludwig Mussigbrod, Philipsburg.
Richard O'Connor, 600 Dakota Street, Butte.
Patten Bros., Earle B. Patten, Philipsburg.
Philipsburg Mining Co., Philipsburg.
N. B. Ringeling, Philipsburg.
Fred Smith, Philipsburg.
J. E. Van Gundy, Philipsburg.
Western Minerals Co., Philipsburg.
Western Ore & Mining Co., Wade A. Siebenthal, general superintendent, Philipsburg.
Prospective shippers—
Butte Cenrtal Mining & Milling Co., Butte.
Donlan & Co., Philipsburg.
Anaconda Copper Co., Butte and Anaconda.
Nevada:
W. S. Holmquist, M. D., Ely.
Prince Consolidated Mining & Smelting Co., 1117 Newhouse Building, Salt Lake City.
Prospective shippers—
J. O. Gillice, Las Vegas.
Nevada Manganese Co., W. S. Elliott, Ely.
Silgoled Mining Co. of Nevada, Arthur Reall, manager, Pioche.

New Mexico:
L. C. Butler, 71 Wall Street, New York, N. Y.
W. M. Dorsey, Silver City.
Lake Valley Mines Co., W. Ziegler, superintendent, Lake Valley.
Moses & Kirchman, Silver City.
Sheriff Mining Co., Box 712, El Paso, Tex.
Stephen Q. Garst, Magdalena (prospective shipper).
North Carolina:
J. B. Thomasson, Kings Mountain.
A. K. Knickerbocker, Hot Springs (prospective shipper).
Oregon:
Kromite Mining Co., T. F. Adams, president, Baker (prospective shipper).
South Carolina:
Atlantic Manganese Co., McCormick.
Tennessee:
A. H. McQueen, Butler.
Maxwell Manganese Mining Co., H. V. Maxwell, general manager, Elizabethton.
Charlton B. Rogers, 154 Fourth Avenue, North Nashville.
Tennessee Manganese Co., J. A. Hull, general manager, Cleveland.
Valley Forge Mining Co., Dr. Hardin Reynolds, Bristol.
Prospective shippers—
W. H. Kemler, Johnson City.
McQueen Manganese Co., Butler.
Manganese Products Co., P. J. Harkins, manager, Newport.
White Oak Manganese Co., C. A. Hall, manager, Canonsburg, Pa.
Texas:
Albert Parent, Duluth, Minn.
Scherer & Whall, Langtry.
Utah:
Burgess Minerals Co., Gustav Sessinghaus, Foster Building, Denver, Colo.
Green River Mining Co., Green River.
Thomas L. McCarthy & Co., Box 217, Eureka.
Michigan-Utah Consolidated Mines Co., 411 Felt Building, Salt Lake City.
W. F. Reeder, Green River.
St. George Chemical Co., 99 John Street, New York, N. Y.
Prospective shippers—
Chief Consolidated Mining Co., Eureka.
Frank H. Leib, Green River.
Utah Manganese Mining Co., W. B. McPherson, secretary, Springville.
Virginia:
C. G. Chevalier, Knickerbocker Building, Baltimore, Md.
Compton Manganese Corporation, John P. Bracken, president, Pittsburgh, Pa.
Crimora Manganese Corporation, 30 East Forty-second Street, New York, N. Y.
Flat Top Manganese Co., E. S. Suffern, president, 96 Wall Street, New York, N. Y.
Hiawassie Mining Co., John S. Draper, president, Pulaski.
Manganese Associates, H. W. Bennett, president, 30 East Forty-second Street, New York, N. Y.
Manganese Products Co., 420 Stephen Girard Building, Philadelphia, Pa.
R. B. Miller, Bluefield, W. Va.
Mount Tory Mining Co., Mark D. Meek, Lyndhurst.
Old Dominion Pig Iron Corporation, Roanoke.
Rockbridge Manganese & Iron Co., Midvale.
St. George Chemical Co., 99 John Street, New York, N. Y.
Seibel Iron Mines (Inc.), 421 Chestnut Street, Philadelphia, Pa.
Shaffer Engineering Co., Nazareth, Pa.
A. T. Short, Amburg.
Southern Exploration Co., 595 Virginia Railway & Power Building, Richmond.
Staleys Creek Manganese & Iron Co., Marion.
Stockwood Realty Corporation, Woodstock.
Union Manganese Corporation (Seaboard Steel & Manganese Corporation), Vesuvius.
United States Manganese & Mineral Co., Zepp.
United States Manganese Corporation (Seaboard Steel & Manganese Corporation), Elkton.
Prospective shippers—
W. R. Cuthbert, Lynchburg.
John B. Guernsey & Co. (Inc.), Strickland Building, Roanoke.
Leckie Moss Co., Burkes Garden.

Virginia—continued.
W. J. Overbeck, 1420 Union Oil Building, Cincinnati, Ohio.
Saunders estate, Evington.
Virginia Ores Corporation, R. O. Brannan, secretary, Lynchburg.
D. A. Vowles, Covington.
Washington—
J. L. Bockover, Humptulips (prospective shipper).
Wisconsin—
Montreal Mining Co., A. C. Bittchofsky, secretary, Wade Building, Cleveland, Ohio.
Wyoming—
Poverty Mining Co., Clifton Wissler, president, Marshall (prospective shipper).

PURCHASERS OF MANGANESE ORES.

Anaconda Copper Co., Butte and Anaconda, Mont.
Alan Wood Iron & Steel Co., Philadelphia, Pa.
Algoma Steel Corporation, Sault Ste. Marie, Ontario, Canada.
Alleghany Ore & Iron Co., Buena Vista and Iron Gate, Va.
American Carbon & Battery Co., East St. Louis, Ill.
American Ever Ready Battery Co., Long Island City, N. Y.
American Manganese Manufacturing Co., Bullit Building, Philadelphia, Pa.
American Smelting & Refining Co., Murray, Utah.
American Steel Foundries, McCormick Building, Chicago, Ill.
Anglo-American Flash Light Co., Pittsburgh, Pa.
James B. Bailey, Pine Forge, Pa.
Beckman & Linden Engineering Corporation, Bay Point, Calif.
Bennett-Brooks, 120 Liberty Street, New York, N. Y.
Berkshire Iron Works, Bullitt Building, Philadelphia, Pa.
Bethlehem Steel Corporation, South Bethlehem, Pa.
Arthur B. Bibbins, Baltimore, Md.
Bilrowe Alloys Co., 201 Bernice Building, Tacoma, Wash.
Binney & Smith, 81 Fulton Street, New York, N. Y.
Charles A. Burdick, E. M., 15 Broad Street, New York, N. Y.
C. F. Burgess Laboratories, Madison, Wis.
L. H. Butcher & Co., Marine Building, San Francisco, Calif.
Cambria Steel Co., Pittsburgh, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Iron & Coal Co., Holt, Ala.
Charcoal Iron Co., Detroit, Mich.
Charles B. Chrystal, 11 Cliff Street, New York, N. Y.
Cleveland-Cliffs Iron Co., Cleveland, Ohio.
Colorado Fuel & Iron Co., Pueblo, Colo.
Corrigan, McKinney & Co., Cleveland, Ohio.
W. R. Cuthbert (National Paint & Manganese Corporation, Lynchburg, Va.).
Delaware River Steel Co., Chester, Pa.
W. H. Dennison, Cushman, Ark.
Electric Reduction Co., Washington, Pa.
Empire Steel & Iron Co., Catasauqua, Pa.
Fuller & Warren Co., Troy, N. Y.
Robert Gilchrist, Elizabethtown, N. J.
M. A. Hanna & Co., 1300 Leader-News Building, Cleveland, Ohio.
Charles Hardy, 50 Church Street, New York, N. Y.
Harshaw, Fuller & Goodwin Co., Electric Building, Cleveland, Ohio.
Hazel-Atlas Glass Co., Clarksburg, W. Va.
W. P. Heath & Co., 509 Olive Street, St. Louis, Mo.
Hickman, Williams & Co., St. Louis, Mo.
C. W. Hill Chemical Co., Los Angeles, Calif.
E. C. Humphries & Co., Pittsburgh, Pa.
Illinois Steel Co., 208 South LaSalle Street, Chicago, Ill.
Import Chemical Co., 276 Water Street, New York, N. Y.
International Smelting Co., Salt Lake City, Utah.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Jaunita Furnace & Foundry Co., 30 West Girard Street, Philadelphia, Pa.
La Belle Iron Works, Steubenville, Ohio.
La Follette Coal & Iron Co., La Follette, Tenn.
Lackawanna Steel Co., Buffalo, N. Y.

J. S. Lamson & Bros. (Inc.), 8 Maiden Lane, New York.
E. J. Lavino & Co., Bullitt Building, Philadelphia, Pa.
C. W. Leavitt & Co., 30 Church Street, New York, N. Y.
Lebanon Blast Furnace Co., Lebanon, Pa.
Levensaler-Spier Corporation, Monadnock Building, San Francisco, Calif.
David Loesser, 1400 Broadway, New York, N. Y.
Los Angeles Pressed Brick Co., Los Angeles, Calif.
Low Moor Iron Co. of Virginia, Lowmoor, Va.
T. L. McCarty, Box 217, Eureka, Utah.
McKeefrey Iron Co., Leetonia, Ohio.
Mangan Iron & Steel Co., 321 Manhattan Building, Duluth, Minn.
Manhattan Electrician Supply Co., 41–47 Morris Street, Jersey City, N. J.
E. E. Marshall, Bullitt Building, Philadelphia, Pa.
Metal and Thermit Corporation, 120 Broadway.
The Metalores Corporation, 56 Pine Street, New York, N. Y.
Miami Metals Co., Tower Building, Chicago, Ill.
Mines & Metal Corporation, 77 Broad Street, New York, N. Y.
Mississippi Valley Iron Co., 6500 South Broadway, St. Louis, Mo.
National Alloy Co., Philadelphia, Pa.
National Carbon Co., Cleveland, Ohio.
Noble Electric Steel Co., 995 Market Street, San Francisco, Calif.
Northwestern Iron Co., Milwaukee, Wis.
Nungesser Carbon & Battery Co., Cleveland, Ohio.
Oakley Paint Manufacturing Co., Los Angeles, Calif.
Old Dominion Pig Iron Corporation, Roanoke, Va.
Pacific Coast Steel Co., San Francisco, Calif.
Pacific Electro Metals Co., Balboa Building, San Francisco, Calif.
Pacific Sewer Pipe Co., Los Angeles, Calif.
Perry Iron Co., Erie, Pa.
Pittsburgh Lamp Brass & Glass Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Pulaski Iron Co., Pulaski, Va.
Republic Iron & Steel Co., Birmingham, Ala.
A. P. Rice, Spencer, Ohio.
Ricketson Mineral Paint Works, Milwaukee, Wis.
Rogers, Brown & Co., 30 Church Street, New York, N. Y.
Frank Samuel, Philadelphia, Pa.
John A. Savage & Co., Duluth, Minn.
Scullin Steel Co., St. Louis, Mo.
Seaboard Steel & Manganese Corporation, 74 Broadway, New York.
Seattle Smelting Co., Van Asselt Station, Seattle, Wash.
Arthur Seligman, 165 Broadway, New York, N. Y.
Shaffer Engineering Co., Nazareth, Pa.
Sligo Furnace Co., 915 Olive Street, St. Louis, Mo.
Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.
C. Soloman, jr., South San Francisco, Calif.
Southern Manganese Corporation, Anniston, Ala.
Standard Steel Works Co., 11th floor, Morris Building, Philadelphia, Pa.
Oscar Stromberg, Tribune Building, New York, N. Y.
The Suffern Co. (Inc.), 96 Wall Street, New York, N. Y.
Superior Portland Cement Co., Concrete, Wash.
Tacoma Metal Co., Tacoma, Wash.
Tennessee Coal, Iron & R. R. Co., Birmingham Ala.
Thomas Iron Co., Hokendauqua, Pa.
Toledo Furnace Co., Toledo, Ohio.
U. S. Glass Co., Pittsburgh, Pa.
United States Smelting, Refining & Mining Co., Salt Lake Ctiy, Utah.
United States Steel Corporation, Empire Building, New York, N. Y.
Utah Iron & Steel Co., Salt Lake City, Utah.
Vanadium Steel Alloys Co., Latrobe, Pa.
Western Reduction Co., Portland, Oreg.
Wharton Steel Co., Morris Building, Philadelphia, Pa.
Wickwire Steel Co., Buffalo, N. Y.
Wisconsin Steel Co., Harvester Building, Chicago, Ill.
Worth Bros. Co., Widener Building, Philadelphia, Pa.
Zenith Furnace Co., Duluth, Minn.

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